



Combustion

Science & Engineering, Inc.

8940 Old Annapolis Road • Suite L • Columbia • MD • 21045 -2129 • Tel: 410 / 884-3266 • Fax: 410 / 884-3267

P. (GOKUL) GOKULAKRISHNAN, Ph.D. (Chemical Engineering)

LEGAL STATUS

Permanent Resident (Green Card holder) in the US with Canadian Citizenship

EDUCATION

NSERC Post-doctoral Fellow, 2002-03, Mechanical & Aerospace Eng., Princeton University, NJ.

Ph.D., 2002, Chemical Engineering, Queen's University, Canada.

M.Sc.(Eng.), 1997, Chemical Engineering, Queen's University, Canada.

B.Sc.(Eng.), 1994, Chemical Engineering, University of Moratuwa, Sri Lanka.

Passed Finalist, 1993, The Chartered Institute of Management Accountants, U.K.

AREAS OF TECHNICAL EXPERTISE

- Modeling of transport processes in reactive flows for design and process optimization
- Chemical Kinetic Models for Practical Fuels such as Gasoline, Jet Fuels, Biofuels, etc.
- Reduced Kinetic Models for CFD Reactive Flow Simulation
- Flame Instability in Scramjets, Gas Turbines and Augmenters
- Chemical Kinetic Modeling of Multi-Phase Coal Gasification and Combustion

PROFESSIONAL MEMBERSHIP

- Senior Member, American Institute of Chemical Engineers (AIChE)
- Member, American Institute of Aeronautics and Astronautics (AIAA)
- Member, American Society of Mechanical Engineers (ASME)
- Member, The Combustion Institute

EXPERIENCE

- **Senior Engineer** Dec. 2003 – present
 - Combustion Science & Engineering, Inc. Columbia, MD
 - Flow reactor experimental system design for ignition delay time measurements of hydrocarbon fuels.
 - Detailed surrogate kinetic mechanism development to predict oxidation behavior of practical hydrocarbons fuels such as Jet fuels.

- Development of reduced kinetic models to implement in CFD to predict flame stability and emissions in gas turbines, augmenters, scramjets and coal gasifiers.
 - Modeling of transport processes of combustion systems for design and optimization, and predictions of energy efficiency, stability and pollutant formation.
 - Chemical reactor modeling of multi-phase, heterogeneous combustion and gasification systems such as coal and biomass gasifiers
- **Post-doctoral Research Fellow** July 2002 – Dec. 2003
 - Princeton University, Dept. of Mechanical & Aerospace Engineering, Princeton, NJ
 - Project: *Fuel Chemistry Models for Simulating Gasoline Kinetics in Internal Combustion Engine Applications*
 - The research project includes experimental and modeling study of the oxidation of gasoline and its surrogate mixtures pertaining to the conditions of an internal combustion engine
 - High-pressure plug-flow reactor experiments to study the oxidation behavior of actual gasoline and its surrogates.
 - Developing a reduced kinetic model to predict the engine performance by validating the model predictions against the experimental data obtained in a high-pressure flow reactor.
- **Graduate Research Assistant** Jan. 1995 – May 2002
 - Queen's University, Dept. of Chemical Engineering, Kingston, Ontario, Canada
 - Projects:
 - *Effect of product gas entrainment on NO_x emission in low-NO_x burners*
 - *NO_x and N₂O emissions from fluidized bed combustion*
 - Responsible for building laboratory-scale fluidized-bed and plug-flow reactors and sampling system to perform experiments
 - Chemical kinetic modeling and analysis of the system to investigate the formation of NO_x and N₂O
 - Development of model reduction techniques for reduced kinetic models
- **Teaching Assistant** Sept. 1995 – Apr. 2001
 - Queen's University, Dept. of Chemical Engineering, Kingston, Ontario, Canada
 - Conducting tutorial sessions for “Heat Transfer” and “Transport Phenomena” undergraduate courses

SELECTED PUBLICATIONS

Refereed Journals

- Gokulakrishnan, P., Ramotowski, M. J., Gaines, G., Fuller, C., Joklik, R., Eskin, L. D., Klassen, M. S. and Roby, R. J. (2008), “A Novel Low NO_x Lean, Premixed, and Prevaporized Combustion System for Liquid Fuels”, *Journal of Engineering for Gas Turbines and Power*, Vol. 130.

- Gokulakrishnan, P., Gaines, G., Currano, J., Klassen, M. S. and Roby, R. J. (2007), “Experimental and Kinetic Modeling of Kerosene-Type Fuels at Gas Turbine Operating Conditions”, *Journal of Engineering for Gas Turbines and Power*, Vol. 129, pp. 655–663.
- Gokulakrishnan, P., McLellan, P. J., Lawrence, A. D. and Grandmaison, E. W. (2005), “Kinetic Analysis and Model Reduction of NO–Sensitized Methane Oxidation”, *Chemical Engineering Science*, Vol. 60, pp. 3683–3692.
- Gokulakrishnan, P., McLellan, P. J., Lawrence, A. D. and Grandmaison, E. W. (2004), “Application of Functional–PCA to Analyze and Reduce Complicated Chemical Mechanisms”, *Computers and Chemical Engineering*, Vol. 30, pp. 1093–1101.
- Gokulakrishnan, P. and Lawrence, A. D. (1999), An Experimental Study of the Inhibiting Effect of Chlorine in a Fluidized Bed Combustor, *Combustion and Flame*, Vol. 116, pp. 640–652.
- Lawrence, A. D., Bu, J. and Gokulakrishnan, P. (1999), “The Interaction between SO₂, NO_x, HCl and Ca in a Bench–Scale Fluidized Combustor”, *Journal of the Institute of Energy*, Vol. 72, pp. 34–40

Conference Proceedings

- Gokulakrishnan, P., Klassen, M. S. and Roby, R. J. (2008), “Ignition Characteristics of A Fischer-Tropsch Synthetic Jet Fuel”, *Proceeding of the International Gas Turbine Institute*, ASME Turbo-Expo, Berlin, Germany, Paper # GT2008-51211.
- Gokulakrishnan, P., Gaines, G., Klassen, M. S. and Roby, R. J. (2007), “Autoignition of Aviation Fuels: Experimental and Modeling Study”, 43rd AIAA/ASME/SAE/ASEE Joint Propulsion Conference & Exhibit, Cincinnati, OH, Paper# AIAA 2007-5701.
- Chaos, M., Zhao, Z., Kazakov, A., Gokulakrishnan, P., Angioletti, M. and Dryer, F. L. (2007), “A PRF+Toluene Surrogate Fuel Model for Simulating Gasoline Kinetics”, *Proceedings of the Fifth US Combustion Meeting*, The Combustion Institute, San Diego, CA.
- Gokulakrishnan, P., Ramotowski, M. J., Gaines, G., Fuller, C., Joklik, R., Eskin, L. D., Klassen, M. S. and Roby, R. J. (2007), “Experimental Study of NO_x Formation in Lean, Premixed, Pre-vaporized Combustion of Fuel Oils at Elevated Pressures”, *Proceeding of the International Gas Turbine Institute*, ASME Turbo-Expo, Montréal, Canada, Paper# GT2007-27552.
- Gokulakrishnan, P., S. Pal, M. S. Klassen, A. J. Hamer, R. J. Roby, O. Kozaka and S. Menon, 2006, “Supersonic Combustion Simulation of Cavity-Stabilized Hydrocarbon Flames using Ethylene Reduced Kinetic Mechanism”, *AIAA/ASME/SAE 42nd Joint Propulsion Conference*, Sacramento, CA, Paper# AIAA 2006-5092.
- Klassen, M. S., P. Gokulakrishnan and S. Menon (2006) “Simulation of Cavity-Stabilized Ethylene Flames for Flameholding Predictions using Reduced Kinetic Mechanisms”, *Joint Army-Navy-NASA-Air Force (JANNAF) Meeting*, San Diego, CA.
- Gokulakrishnan, P., Kwon, S., Hamer, A. J., Klassen, M. S. and Roby, R. J. (2006), “Reduced Kinetic Mechanism for Reactive Flow Simulation of Syngas/Methane Combustion at Gas Turbine Conditions”, *Proceeding of the International Gas Turbine Institute*, ASME Turbo-Expo, Barcelona, Spain, Paper# GT2006-90573.

- Gokulakrishnan, P., Klassen, M. S. and Roby, R. J. (2005), “Development of Detailed Kinetic Mechanism to Study Low Temperature Ignition Phenomenon of Kerosene”, *Proceeding of the International Gas Turbine Institute, ASME Turbo-Expo, Reno, Nevada, Paper #GT2005-68268. (received best paper award from the Combustion & Fuel Committee of IGTT).*
- Gokulakrishnan, P., Kazakov, A. and Dryer, F. L., 2003, “Comparison of Numerical and Experimental Kinetic Data for Flow Reactor Systems: Mixing Effects”, *Proceedings of the Third US Combustion Meeting, The Combustion Institute, Chicago, IL.*
- Bu, J., Lawrence, A. D. and Gokulakrishnan, P. (1999), “A Study of the Combined S, N, HCl and Ca Chemistry in a Bench Scale Fluidized Combustor”, *ASME 15th International Conference on Fluidized Bed Combustion, Savannah, Georgia, Paper # FBC99-0072.*
- Gokulakrishnan, P. and Lawrence, A. D. (1997), “A Detailed Study of the Role of Halogens in the Inhibition of Nitrogen Oxide Formation in Fluidized Bed Incinerators”, *ASME 14th International Conference on Fluidized Bed Combustion, Vancouver, British Columbia, pp 1123-1129.*